

## Activity 4: Building a Solar Oven

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Engineering Design Problem:

Use what you have learned and the materials provided to build a solar oven that can attain as high a temperature as possible.

### Engineering Design Specifications and Constraints

- The oven's interior must be big enough to hold your cooking container and a thermometer. You will need room to bake at least a few cookies on a piece of foil or heat water in a small cup. To meet these requirements, the bottom must be at least 6"x6" and the walls must be at least 4" tall. If your boxes are bigger, you may choose to increase the size.
- The oven must open and close to allow you to put in and take out food and to put a thermometer in place.
- The oven bag must be used to make a transparent window. You must find a way to attach it to your oven to create a lid.

### Design Strategies

#### Reduce heat loss through conduction.

- Place insulating material in the space between the inner and outer walls to reduce heat loss. Use the results from your experiments in Activity 3 as a guide. If you have limited amounts of the best insulation materials, be sure to use them to the best advantage.
- Construct a secure lid to keep heat from escaping. Think of the car analogy. If we open the door of the heated car, hot air flows out, and the temperature inside drops. In the case of our ovens, however, we want to keep the hot air inside. Though you must be able to open and close the lid, you want it to seal as tightly as possible when shut.

### Design Strategies (cont)

#### Increase heat-gain from solar radiation.

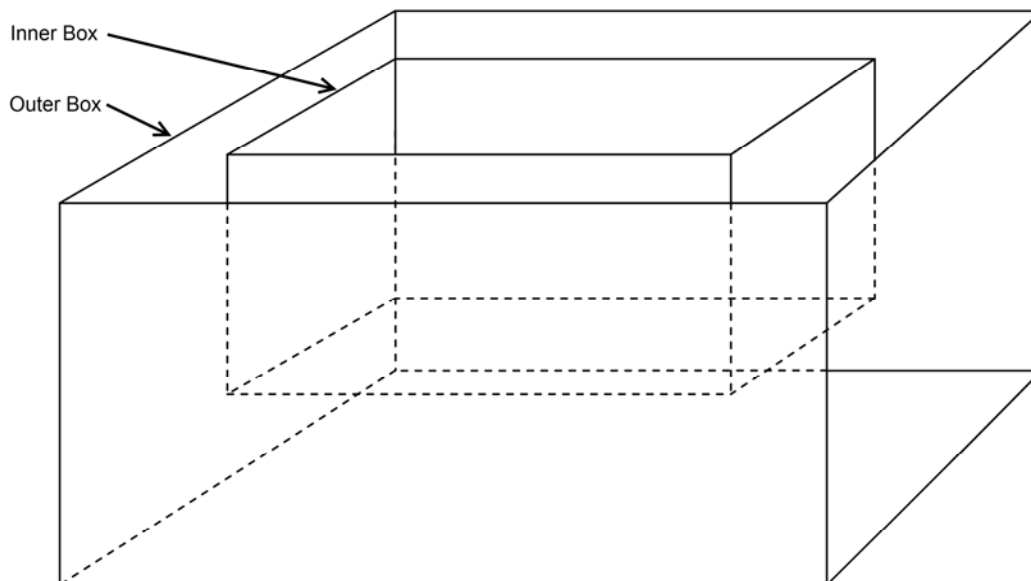
- Experiment with making portions of the interior black using construction paper, tape, or paint if available. The color of the interior surfaces affects the amount of energy transferred from radiative energy (sunlight) to heat.
- Devise a way to move the oven during cooking so that the sun is always directed into the oven. You might use blocks to prop the oven up to point at the sun.
- As you found in the activity with the different colored pans, use dark-colored containers for cooking. They will absorb more heat than lighter-colored containers.

#### Increase amount of solar radiation entering the oven.

- Reflect sunlight toward the cooking area. You can place objects outside the oven to catch and reflect light toward the opening of the oven. You must decide how to build and where to place the reflectors to direct as much light as possible.

### Analysis

To test your oven, place it outside on a sunny day. Measure the air temperature inside the oven. Continue measuring the temperature every 10 minutes, graphing your results. After the first 30 minutes, you may take measurements less often. Compile your data with the rest of the class so that everyone can observe the different heating curves the other groups obtained.



This basics of the solar oven: a box within a box.

### Questions:

Was it cloudy, partly cloudy or sunny when you tested your solar oven?	
What was the temperature outdoors during your test?	
What time of day did you perform your test?	
What temperature did your solar oven reach in 30 minutes?	

Draw a diagram of your solar oven below. Indicate where there is heat transfer due to radiation and indicate where there is heat transfer due to conduction.

Explain how a solar oven works.

What aspects of your solar oven design worked well?